

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
11 April 2002 (11.04.2002)

PCT

(10) International Publication Number  
**WO 02/028532 A3**

(51) International Patent Classification<sup>7</sup>: **B01L 3/00**,  
B01J 19/00

(21) International Application Number: PCT/US01/31333

(22) International Filing Date: 5 October 2001 (05.10.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/239,063 6 October 2000 (06.10.2000) US  
60/239,010 6 October 2000 (06.10.2000) US  
60/238,805 6 October 2000 (06.10.2000) US  
60/238,390 6 October 2000 (06.10.2000) US

(71) Applicant (for all designated States except US): **PROTASIS CORPORATION** [US/US]; 734 Forest Street, Marlborough, MA 01752 (US).

(72) Inventors; and

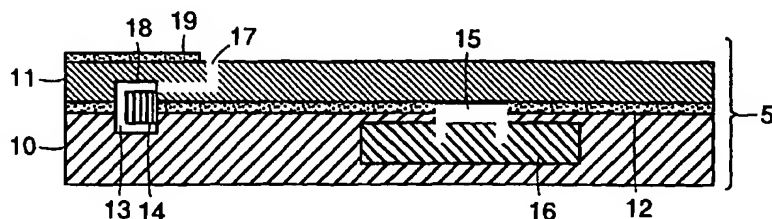
(75) Inventors/Applicants (for US only): **STRAND, David** [US/US]; 734 Forest Street, Marlborough, MA 01752 (US). **ANTOCCI, Joe** [US/US]; 101 Old Farm Road, Leominster, MA 01453 (US). **MYERS, Peter** [GB/GB]; 19 Woodlea Close, Bromborough, Wirral L62 6DL (GB). **MYERS, Tim** [GB/GB]; 19 Woodlea Close, Bromborough, Wirral L62 6DL (GB). **BARROW, David** [GB/GB]; 61 Lake Road West, Roath Park, Cardiff CF2 35PH (GB). **CEFAI, Joseph** [GB/GB]; 14 Quarry Road, Swansea SA5 9DJ (GB).

(74) Agents: **MCDERMOTT, Peter, D.** et al.; Banner & Witcoff, Ltd., 28th floor, 28 State Street, Boston, MA 02109-1775 (US).

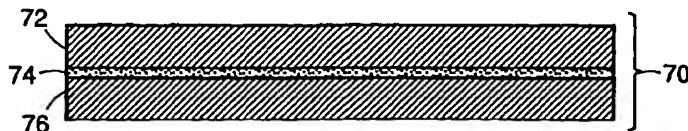
(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,

[Continued on next page]

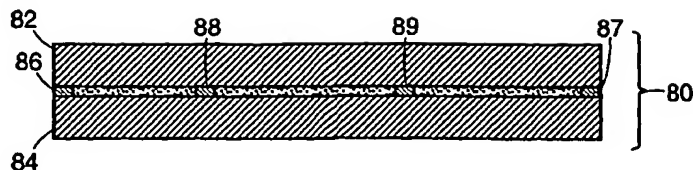
(54) Title: MICROFLUIDIC SUBSTRATE ASSEMBLY AND METHOD FOR MAKING SAME



A



B



C

(57) Abstract: A novel microfluidic substrate assembly and method for making the same are disclosed. The substrate assembly comprises a multi-layer laminated substrate defining at least one fluid inlet port and at least one microscale fluid flow channel within the multi-layer substrate in fluid communication with the inlet port for transport of fluid. The substrate assembly may optionally comprise additional components and elements located within the substrate assembly or attached to the substrate assembly.

WO 02/028532 A3

BEST AVAILABLE COPY



GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

— with international search report

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF,

(88) Date of publication of the international search report:  
6 February 2003

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/31333

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 B01L3/00 B01J19/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 39 15 920 A (MESSERSCHMITT BOELKOW BLOHM) 22 November 1990 (1990-11-22) column 2, line 64 -column 3, line 22 column 5, line 1 -column 6, line 3 column 7, line 47 -column 7, line 65 figures 6-10	1-5, 10-12
X	--- WO 99 60397 A (UNIV WASHINGTON) 25 November 1999 (1999-11-25) page 2, line 1 -page 5, line 2 page 8, line 3 -page 8, line 11 page 10, line 7 -page 11, line 25 page 12, line 23 -page 13, line 13 page 14, line 12 -page 15, line 23 page 16, line 7 -page 19, line 8 figures 6,7,11-13 -----	1-3,5, 13,14

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

17 June 2002

Date of mailing of the international search report

16.10.2002

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax: (+31-70) 340-3016

Authorized officer

Tiede, R

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 01/31333

## Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet.

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-5,10-14

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-5,10-14

1.1. Claims: 1-3

A multi-layer laminated substrate with inlet ports, a flow channel and an operative component, such as a reservoir

1.2. Claim : 4

A multi-layer laminated substrate with inlet ports, a flow channel and an operative component, the operative component is a light sensor

1.3. Claim : 5

A multi-layer laminated substrate with inlet ports, a flow channel and an operative component, the operative component is a ultrasonic actuator or transducer

1.4. Claim : 10

A multi-layer laminated substrate with inlet ports, a flow channel and an operative component, said substrate assembly further comprises an outlet port in fluid communication with the inlet port

1.5. Claims: 11,12

A multi-layer laminated substrate with inlet ports, a flow channel and an operative component, the operative component is at least one electronic memory unit mounted to the substrate and operatively connected thereto

1.6. Claims: 13,14

A multi-layer laminated substrate with at least one inlet port and one flow channel at each of more than one level within said substrate and at least one channel via extending between levels within said substrate

2. Claims: 6-8

A multi-layer laminated substrate with inlet ports, a flow channel and an operative component, the operative component is operative to generate fluid pressure in a flow channel

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

3. Claim : 9

A multi-layer laminated substrate with inlet ports, a flow channel and an operative component, the operative component is operative to induce flow in a flow channel by endosmotically or electrochemical evolution of gases

4. Claims: 15-20

A multi-layer laminated substrate with inlet ports, a flow channel, at least one layer formed of plastic and said assembly is operative and fluid tight at fluid pressures in the channel in excess of about 100 psi

5. Claims: 20-26

A multi-layer laminated substrate with inlet ports, a flow channel at least one layer is formed of PEEK

6. Claims: 27-35

A multi-layer laminated substrate with inlet ports, a flow channel and at least first and second layers are selectively welded to each other to form a fluid-tight seal at least along a channel within said substrate assembly.  
A method of producing a multi-layer laminated substrate comprising the steps of forming a surface-to-surface interface between two substrates to form a substrate sub-assembly having an internal fluid channel at the interface, exposing the sub-assembly to radiation to heat only one or more selected portions of the interface to a temperature to weld the substrate components together, to form a fluid tight seal between the substrate components along the fluid channel

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/31333

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 3915920 A	22-11-1990	NONE	
WO 9960397 A	25-11-1999	AU 3771599 A CA 2320296 A EP 1046032 A	06-12-1999 25-11-1999 25-10-2000

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**